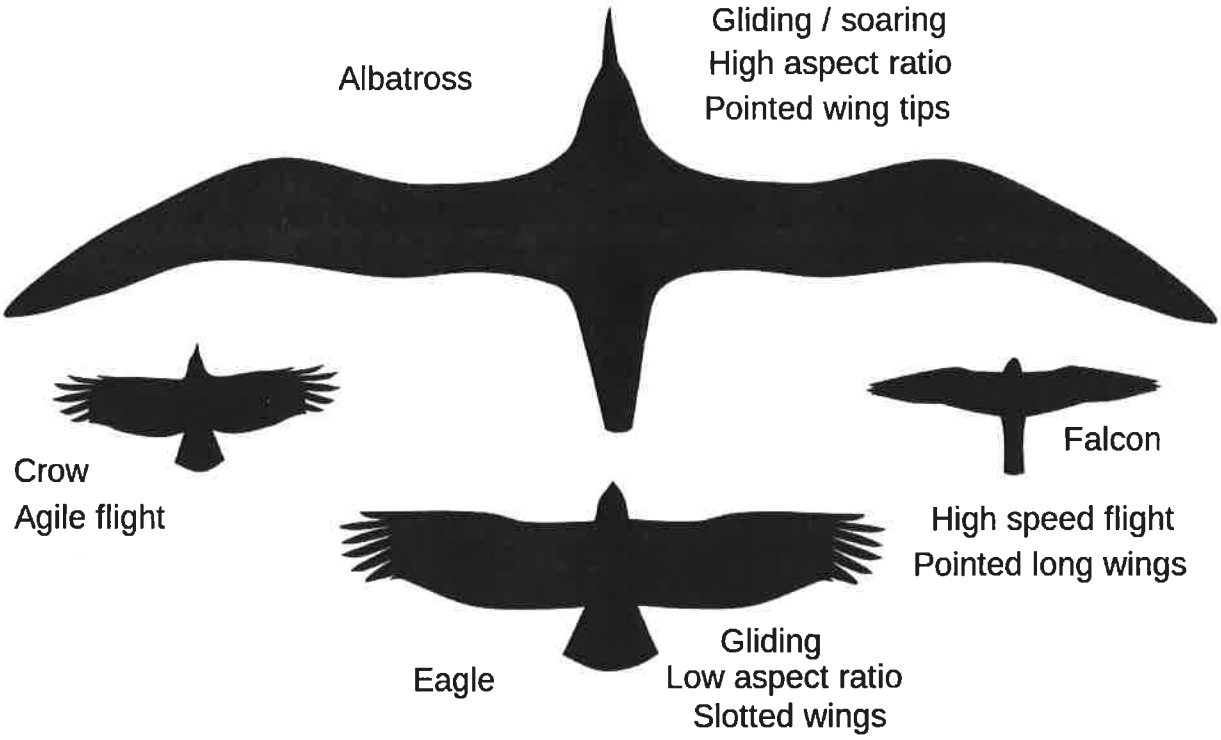
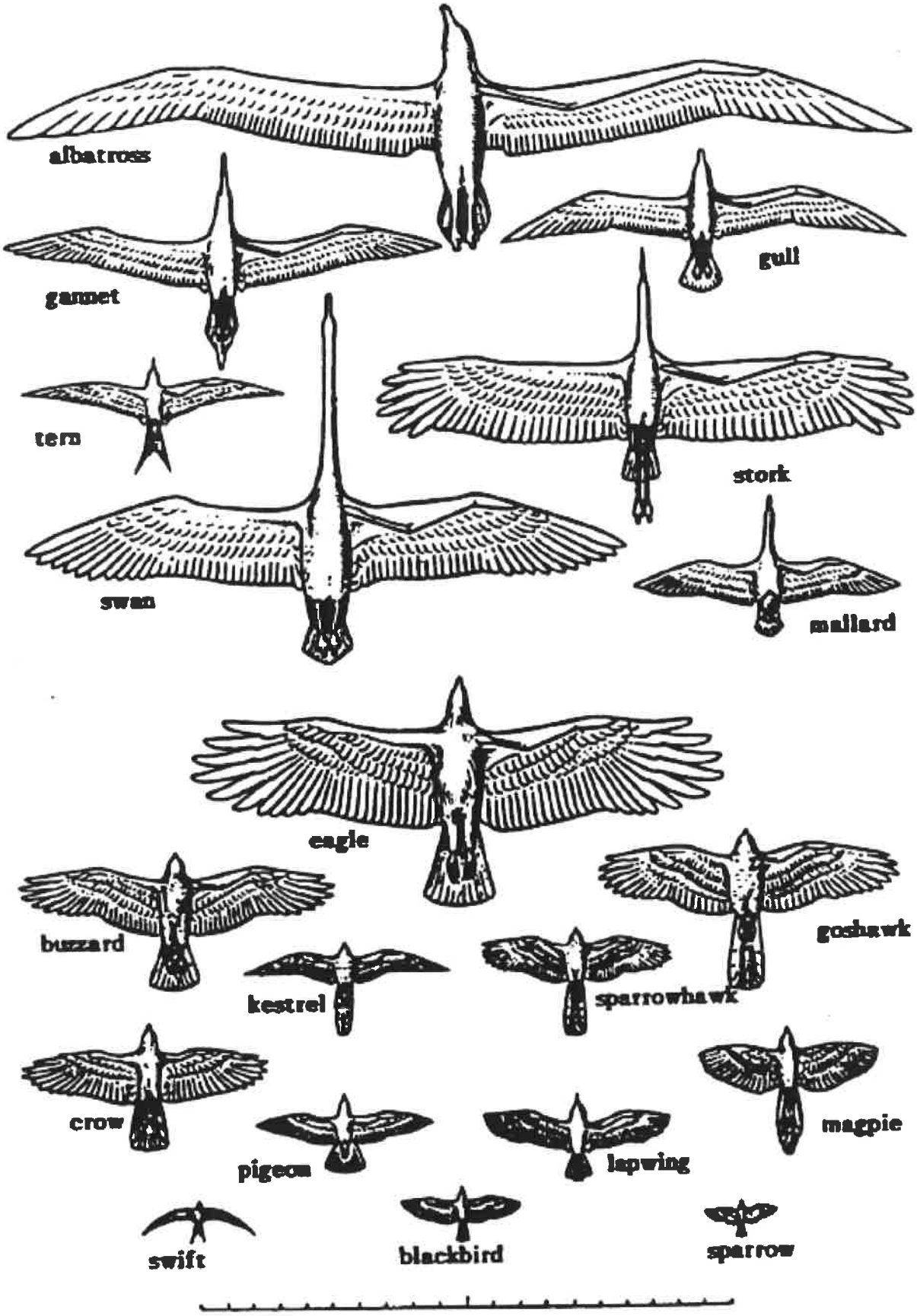
Lesson 28

Birds

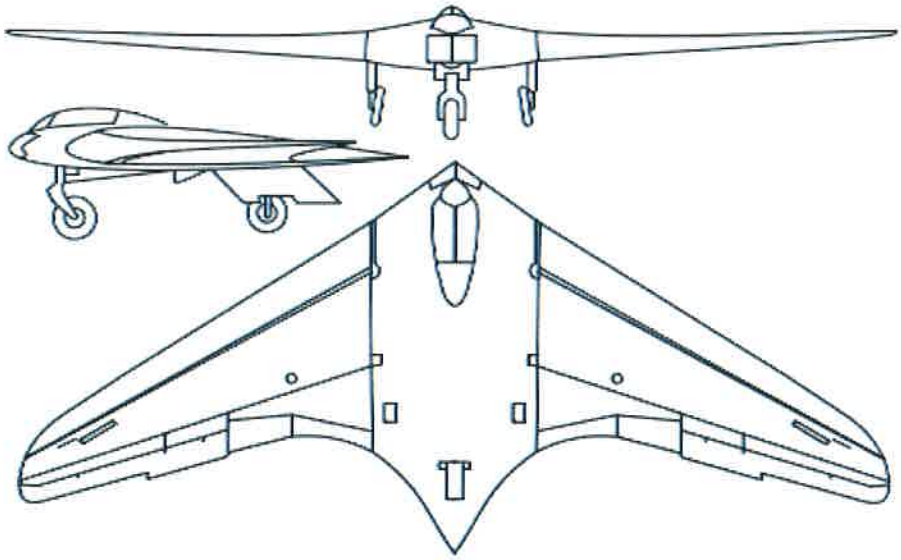


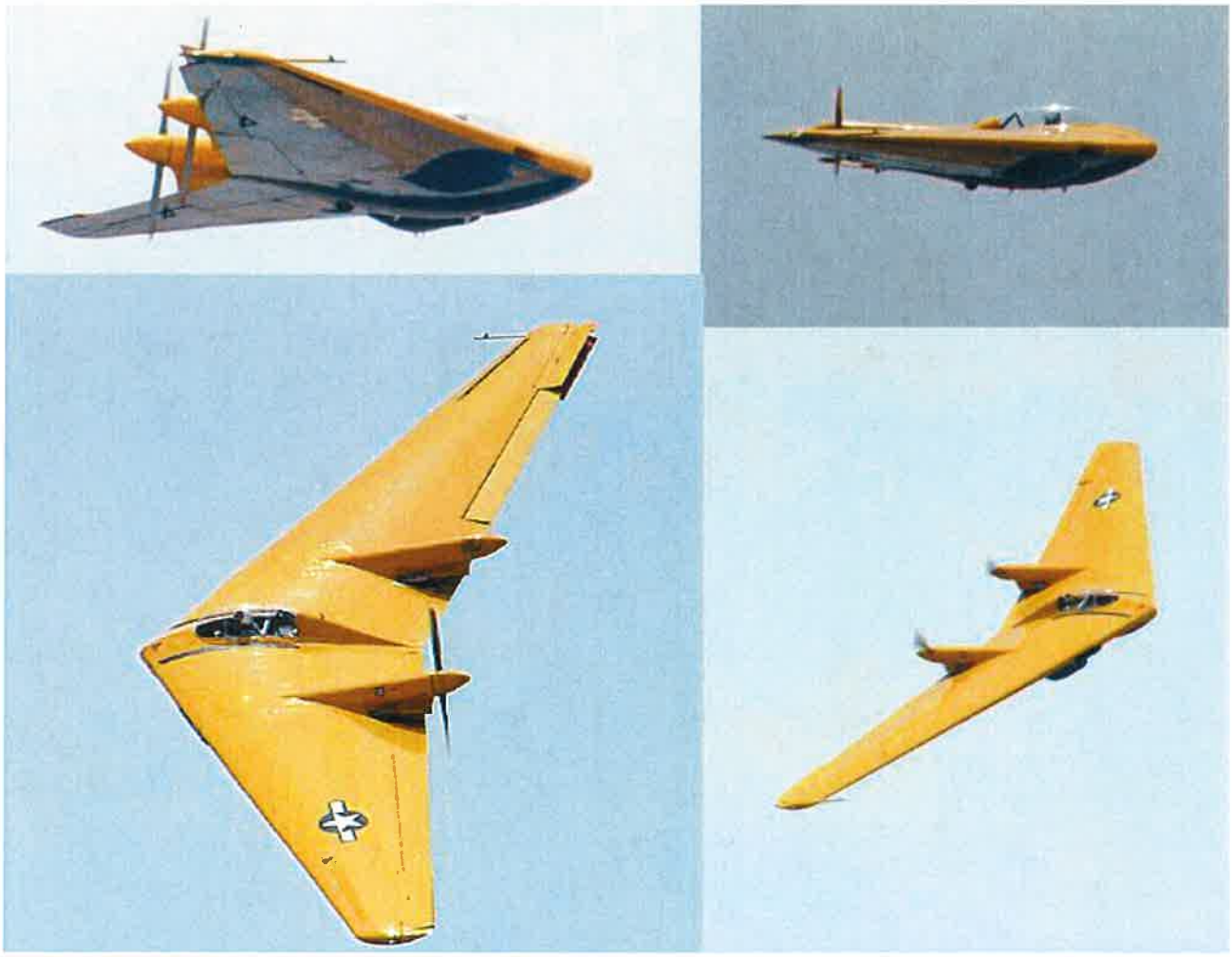
Shyamal, 2007

http://www.birds.cornell.edu/education/kids/books/wingshapes


albatross
gannet
gull
tern
stork
swan
mallard
eagle
buzzard
goshawk
kestrel
sparrowhawk
crow
magpie
pigeon
lapwing
swift
blackbird
sparrow

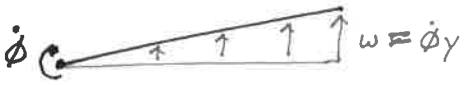
Rayner, 1998





Flapping Wings

Assume linear flapping and symmetrical flapping. • Neglect unsteady terms



$$\alpha_{geometry} \approx \frac{\dot{\phi} y}{V_\infty}$$

Given that the flapping changes the geometric AOA across the span, the induced drag will be higher than optimal. (i.e no longer an elliptical lift distribution)

How do swans remedy this extra induced drag issue? They twist their wings during the flapping! tiny.cc/AEM313 Swan 0:00 - 1:03

Aside: Have you ever noticed that birds appear to generate anhedral during their landing approach? View 5:15 - 6:00 and look at the feathers on the inboard portions of the wing. What is the bird doing?!! why is there anhedral? Have you ever seen a stall/spin accident with a bird? No.

The twist (washout) would tend to return the wing to an elliptical lift distribution.

Of course, the bird's propulsion is through a tilted lift vector. tips provide thrust.